Short Form Work Paper WPSDGEREHC0024

**Revision 2**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Efficient Fan Controller for Residential Air Conditioners**

**December 15, 2016**

# Efficient Fan Controller for Residential Conditioners Short Form WP

## Introduction

This short form workpaper (WP) documents the values adopted from SCE’s workpaper entitled “Efficient Fan Controller for Residential Air Conditioners and Furnaces” (SCE13HC052 Rev 2). SDG&E adopts all of the values associated with our climate zone as stated in SCE13HC052 Rev 2 workpaper with the following exceptions:

1. SDG&E intends to use the “SDG:DEER:Res:HVAC\_Eff\_AC” E3 load shape.
2. SDG&E intends to offer Energy Impacts Common Units per controller or each. For SDG&E, the savings are normalized to a “per controller” value using tonnages for each building type extracted from the MASControl tool. These tonnages are 3.184, 2.123, and 1.122 for single family, double wide mobile home, and multi-family, respectively;
3. SDG&E intends to provide Measure Cost per unit ($/unit). The controller cost is also normalized on a per-ton basis using the average rated capacities of the HVAC systems in the DEER eQuest models for DMO, MFM, and SFM. The average rated capacities for DMO, MFM, and SFM are 2.123, 1.122, and 3.184 tons, respectively;
4. SDG&E intends to use a Net-to-Gross Ratio “Res-Default>2” with 0.55 value.
5. SDG&E intends to use EUL\_ID of “HV-ResAC”;

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 10/25/10 |  | Adapted from SoCalGas Workpaper SCG0077 Revision #0 dated April 4, 2010, developed by Verified, Inc. Revised weighting in multiple tables for SDGE Climate zones. Added SDGE Work paper number. |
| **1** | **08/25/14** | **Phillip Hasley (Hasley Consulting)** | - Adopted SCE Work Paper SCE13HC052.1  - Updated Workpaper name  - Removed calculation template  - Removed Table of Contents  - Replaced summary tables with At-A-Glance Summary  - Updated EUL\_ID  - Updated NTG  - Added GSIA  - Updated load shapes  - Updated building types |
| **2** | 12/15/16 | Eduardo Reynoso (SDG&E) | Adopted Short Form Workpaper based on referencing IOU lead workpaper by SCE, SCE13HC052 Rev2. |

Table 1: Measure Summary Table

|  |  |
| --- | --- |
| **Section** | **Value** |
| **1.1 Measure & Baseline Data** | The retrofit add-on of an efficient fan controller (EFC) device onto a residential single-family, multi-family or double-wide mobile home split-system air conditioner. The base case is a 14 SEER AC unit without an EFC and without a built in fan delay. |
| **1.2 Technical Description** | EFC devices delay the evaporator fan cycle off time to take advantage of the residual liquid refrigerant remaining in the evaporator after the compressor cycles off. The controller can delay the fan cycle off time either by allowing the user to set the time delay period, or by using built-in logic to delay the fan cycle off time based on the compressor run time. This work paper only allows the installation of a fan controller with built-in logic, heretofore after referred to as “automated fan controller,” unless the manually set time delay is set and commissioned by a trained contractor. |
| Measure 1 (placeholder)  Measure 2 (placeholder)  Measure 3 (placeholder)  Measure 4 | Measures 1, 2 and 3 are legacy placeholders and are necessary for SDG&E Ex-ante database alignment.  Measure 4 (462282, 420156): Fan controller device using built-in logic to delay the evaporator fan cycle off time. |
| Code for Measure  **(Cited per SCE Workpaper as stated in Document Revision History)** | There is no code or other jurisdictional requirements related to these measures. However, starting in 2015 federal code requires a packaged residential AC unit installed in California to have a SEER (Seasonal Energy Efficiency Ratio) rating of at least 14. This efficiency rating was used to establish the baseline AC unit for this measure. |
| Requirements | * This measure only applies to residential split-system air conditioning units with an indoor evaporator coil. The baseline air conditioning system cannot have built-in delay. * This work paper only allows the installation of an automated fan controller, unless the manually-set time-delay fan controller is set and commissioned by a trained contractor. This measure can be installed in single family, multi-family, and double-wide mobile homes in all SDG&E climate zones. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | Retrofit Add-On (REA) |
| Delivery Mechanisms | * Financial Support – Downstream Prescriptive Rebate -“PreRebDown” * Deemed and Financial Support/Direct Install |
| **1.4.1 DEER Data** |  |
| DEER Measure ID | DEER does not contain this type of measure. |
| Net-to-Gross Ratio | Com-Default>2yrs |
| Effective and Remaining Useful Life  **(Cited per SCE Workpaper as stated in Document Revision History)** | EUL\_ID / RUL\_ID : HV-ResAC = 15 / 5 years  The EUL of the measure is capped at the remaining useful life of split and package equipment, as it is assumed that the controller would be removed with the equipment once it reaches its remaining useful life. Refer to the Ex-Ante Database for the EUL and RUL values. |
| **Section 2. Calculation Methodology**  **(Cited per SCE Workpaper as stated in Document Revision History)** | Energy savings was calculated using eQuest v3.64 to establish the baseline energy consumption then applying the part load ratio curve fit equation from the ET report. The eQuest simulations used a minimally above-code SEER 14 split-AC system to be slightly conservative. The cooling capacity varied by building type and climate zone based on the DEER building prototypes for double-wide mobile home, multi-family, and single family residential buildings. For SDG&E, the savings are normalized to a “per controller” value using tonnages for each building type extracted from the MASControl tool. These tonnages are 3.184, 2.123, and 1.122 for single family, double wide mobile home, and multi-family, respectively.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | | Impacts | | | | | BldgType | Climate Zn | KWh/ton | KW/ton | KWh/each | KW/each | | DMo | 6 | 7.415 | 0.001 | 15.742 | 0.003 | | DMo | 7 | 15.843 | 0.000 | 33.635 | 0.000 | | DMo | 8 | 43.093 | 0.020 | 91.487 | 0.043 | | DMo | 10 | 90.611 | 0.057 | 192.368 | 0.122 | | DMo | 14 | 105.550 | 0.066 | 224.082 | 0.140 | | DMo | 15 | 215.529 | 0.047 | 457.567 | 0.100 | | MFm | 6 | 6.710 | 0.001 | 7.528 | 0.001 | | MFm | 7 | 10.397 | 0.005 | 11.666 | 0.006 | | MFm | 8 | 24.850 | 0.007 | 27.881 | 0.007 | | MFm | 10 | 55.120 | 0.055 | 61.845 | 0.062 | | MFm | 14 | 70.317 | 0.059 | 78.896 | 0.066 | | MFm | 15 | 174.247 | 0.059 | 195.505 | 0.066 | | SFm | 6 | 13.457 | 0.001 | 42.846 | 0.002 | | SFm | 7 | 23.650 | 0.006 | 75.303 | 0.020 | | SFm | 8 | 52.753 | 0.025 | 167.966 | 0.080 | | SFm | 10 | 98.394 | 0.051 | 313.288 | 0.163 | | SFm | 14 | 109.927 | 0.061 | 350.006 | 0.196 | | SFm | 15 | 217.884 | 0.046 | 693.743 | 0.146 | |  |  |  |  |  |  | |
| **Units** | Per Controller (each) |
| **Section 3. Load Shapes** | SDG:DEER:Res:HVAC\_Eff\_AC |
| **Section 4. Costs** |  |
| Units | Per Controller (each) |
|  | Downstream Prescriptive Rebate  (All Cost References per SCE Workpaper-Lead IOU) |
| Base Cost – Measure 4 | = $0.00 |
| Measure Cost – Measure 4 | = Equipment Cost +Labor Cost = $28.50 +135.76 = $164.26/controller (each) |
| Incremental Cost – Measure 4 | = $ 164.26/Controller (each) |
|  | Direct Install |
| DI Cost Measure 4 | = DI Material Cost + DI Material Cost = $64.60 +78.95  = $143.55/controller (each) |